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UNITED STATES STANDARDS FOR HONEY[1]

Recommended by the United States Department of Agriculture

Prepared by the Bureaus of Entomology and Agricultural Economics

CONTENTS

	Page
Introduction	1
Grades for section comb honey	2
Grades for shallow-frame comb honey	7
Grades for cut-comb honey	8
Grades for extracted honey	9
Definitions of terms	10
Color classification for comb honey	12
Packing and marking requirements for comb honey	13
The practice of grading comb honey	15
Definition of honey	24
Federal pure food law requirements for honey	24
Grading extracted honey	25

INTRODUCTION

As the result of recent studies made possible by the cooperation of the Bureau of Agricultural Economics with the Division of Bee Culture Investigations of the Bureau of Entomology, the following rules have been adopted for grading honey, for the guidance of beekeepers in preparing honey for market, and for convenience in buying and selling honey.

Grading rules for both comb and extracted honey are included in this circular. The information contained in United States Department of Agriculture Circular 364, "The Color Grading of Honey," is now given in this publication, which also contains other information intended to be helpful in grading and packing honey.

Before beginning to grade honey this entire circular should be read carefully. Definitions and explanations of terms as used in these grades are given on page 10. The terms defined are indicated by letters in parentheses and following the words defined.

[1] This circular has been prepared by E. L. Sechrist, associate apiculturist, under the general direction of James I. Hambleton, apiculturist, Bureau of Entomology, and H. W. Samson, assistant chief marketing specialist, and in close consultation with R. R. Pailthorp and William E. Lewis, marketing specialists, Bureau of Agricultural Economics.

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GRADES FOR SECTION COMB HONEY

UNITED STATES FANCY SECTION HONEY

United States Fancy section honey shall meet the following requirements:

1. The honey shall be free from cells of pollen and from damage (*a*) [2] caused by granulation, honeydew, poorly ripened or sour honey, any objectionable flavor from floral source, taint of smoke, carbolic acid, other foreign flavor, odor, or damage caused by other means.
2. The honey in any comb must be uniform in color (*b*). (See "Color classification," p. 12.)
3. Each section shall conform to the requirements of the official color chart (*c*) as to color of comb and cappings (*d*), freedom from excessive propolis and pronounced stains (*e*).
4. The sections shall be new in appearance (*f*) and of white wood (*g*). Unless otherwise specified, they shall be well packed (*h*) in new 24-section cases.
5. The comb shall not project beyond the wood of the section (*i*).
6. The surface of the comb must be dry, free from any sign of weeping (*j*), and from damage caused by bruising (*k*) or by any other means.[3]
7. Each comb shall be firmly attached (*l*) to all four sides of the section if the outside row of cells next to the wood is empty. If this outside row is filled with honey the comb must be well attached (*l*) to all four sides.
8. In three-fourths of the sections not more than 2¼ linear inches of through holes (*m*) next to the wood shall be permitted; in the remaining 25 per cent of the sections not to exceed 2¾ linear inches of through holes are permitted. No dry holes (*m*) are permitted in the body of the comb.
9. All cells other than the outside row next the wood shall be evenly capped (*n*). Open or empty cells (*o*) are permitted only in the outside row next to the wood.
10. Unless otherwise specified, the minimum net weight (*p*) shall be 12 ounces. (See p. 13.)

TOLERANCES

In order to allow for variations, other than in weight, incident to proper grading and handling, not more than 5 per cent by count of the sections in any lot may be below the requirements for the grade, but not to exceed two-fifths of this tolerance, or 2 per cent, shall be allowed for defects causing serious damage (*a*).

In addition to the foregoing tolerance, not more than 5 per cent by count of the sections in any lot may not meet the weight requirements, but the weight of no section shall be more than one-half ounce below the minimum net weight.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

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[2] The letters in parentheses and following certain words indicate that these words are further defined. (See "Definitions of terms," p. 10.)

[3] Weeping, bruising, or other damage developing in transit on honey otherwise up to grade shall be considered as affecting the condition, but not the grade.

UNITED STATES NO. 1 SECTION HONEY

United States No. 1 section honey shall meet the following requirements:

1. The honey shall be free from cells of pollen, and from damage (*a*) caused by granulation, honeydew, poorly ripened or sour honey, any objectionable flavor from the floral source, taint of smoke, carbolic acid, other foreign flavor, odor, or damage caused by other means.

2. The honey in any comb must be uniform in color (*b*) except that, in one-third of the combs in a case, honey of a fairly uniform color (*b*) is permitted. (See "Color classification," p. 12.)

3. Each section shall conform to the requirements of the official color chart (*c*) as to color of comb and cappings (*d*), freedom from excessive propolis and pronounced stains (*e*).

4. The sections shall be new in appearance (*f*), of white wood (*g*), and well packed (*h*) in cases of new appearance, which shall be 24-section cases unless otherwise specified; except that honey which would otherwise grade as United States Fancy, but which is in sections only slightly below the standard, shall grade as United States No. 1. Honey which would otherwise grade as United States No. 1 shall grade as No. 2, if in sections that are below the standard for the No. 1 grade.

5. The comb shall not project beyond the wood of the section (*i*).

6. The surface of the comb must be dry, free from any sign of weeping (*j*), and from damage caused by bruising (*k*) or by any other means.[4]

7. Each comb shall be well attached (*l*) to all four sides of the section.

8. In three-fourths of the sections not more than 3¾ linear inches of through holes (*m*) next the wood shall be permitted; in the remaining 25 per cent of the sections not to exceed 4¼ linear inches of through holes are permitted. No dry holes (*m*) are permitted in the body of the comb.

9. The capping shall be even (*n*), except for slight irregularities of surface (*n*) affecting not to exceed one-half of the comb surface. Open cells shall not be permitted in the body of the comb, but are permitted in the outside row next to the wood, and in addition one-half the sections in any case may have open cells at any corner, along the lower edge, or in the row of cells adjoining the outside row. Open cells, exclusive of those in the outside row, shall not exceed 25 in number on a comb weighing over 12 ounces net (*p*), or 12 open cells on a comb weighing between 11 and 12 ounces net, inclusive. Of the total number of open cells, exclusive of those in the outside row, not more than 6 may be empty (*o*).

10. Unless otherwise specified, the minimum net weight (*p*) for this grade shall be 11 ounces. (See p. 13.)

UNITED STATES NO. 1 MIXED COLOR SECTION HONEY

United States No. 1 Mixed Color section honey shall meet all the requirements of United States No. 1 section honey except as to color.

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[4] Weeping, bruising, or other damage developing in transit on honey otherwise up to grade shall be considered as affecting the condition, but not the grade.

TOLERANCES

In order to allow for variations, other than in weight, incident to proper grading and handling, not more than 5 per cent by count of the sections in any lot may be below the requirements for the grade, but not to exceed two-fifths of this tolerance, or 2 per cent, shall be allowed for defects causing serious damage (*a*).

In addition to the foregoing tolerance, not more than 5 per cent by count of the sections in any lot may not meet the weight requirements, but the weight of no section shall be more than one-half ounce below the minimum net weight.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

UNITED STATES NO. 2 SECTION HONEY

United States No. 2 section honey shall meet the following requirements:

1. The honey shall be free from serious damage (*a*) caused by cells of pollen, honeydew, poorly ripened or sour honey, any objectionable flavor from the floral source, taint of smoke, carbolic acid, other foreign flavor, odor, or damage caused by other means.
2. No requirement is made for uniformity in color of the honey (*b*) in any combs of this grade.
3. Each section shall conform to the requirements of the official color chart (*c*) as to color of comb and cappings (*d*), freedom from excessive propolis and pronounced stains (*e*).
4. Unless otherwise specified, the sections shall be new in appearance (*f*) and of white wood (*g*). Sections which are not well cleaned or white enough to be permitted in the higher grades are permitted in the No. 2 grade, but must be so specified.
5. The comb shall not project beyond the wood of the section (*i*).
6. The comb shall not be badly bruised, marred, or leaking. Holes cut in cappings or small broken surfaces are permitted.
7. Each comb shall be well attached (*l*).
8. In three-fourths of the sections not more than 6 linear inches of through holes (*m*) next the wood shall be permitted; in the remaining 25 per cent of the sections not to exceed 6½ linear inches of through holes are permitted. No dry hole (*m*) larger than three-eighths inch across shall be permitted if it extends more than 1⅜ inches from the wood.
9. The capping may be uneven. Open cells (*o*) shall be permitted in the outside row next to the wood, and in addition each comb may have not more than 50 open cells on a comb weighing over 11 ounces net (*p*), or 20 open cells on a comb weighing between 10 and 11 ounces net, inclusive. Not more than 5 open or empty cells (*o*) may be on the body of the comb away from the open cells at the corners or edges. Of the total number of open cells, exclusive of those in the outside row, not more than 20 cells may be empty.
10. Unless otherwise specified, the minimum net weight (*p*) for this grade is 10 ounces. (See p. 13.)

TOLERANCES

In order to allow for variations, other than in weight, incident to proper grading and handling, not more than 5 per cent by count of the sections in any lot may be below the requirements for the grade.

In addition to the foregoing tolerance, not more than 5 per cent by count of the sections in any lot may not meet the weight requirements, but the weight of no section shall be more than one-half ounce below the minimum net weight.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

UNITED STATES EXHIBITION SECTION HONEY

United States Exhibition section honey[5] shall meet the following requirements:

1. The honey shall be free from cells of pollen, granulation, honeydew, poorly ripened or sour honey, any objectionable flavor from the floral source, taint of smoke, carbolic acid, other foreign odor, or damage caused by other means.
2. The honey in any comb must be uniform in color (*b*). (See "Color classification," p. 12.)
3. Each section shall conform to the requirements of the official color chart (*c*) as to color of comb and cappings (*d*), freedom from excessive propolis and pronounced stains (*e*).
4. The sections shall be new in appearance (*f*) and of white wood (*g*). Unless otherwise specified, they shall be well packed (*h*) in new 24-section cases.
5. The comb shall not project beyond the wood of the section (*i*).
6. The surface of the comb must be dry, free from any sign of weeping (*j*), bruising (*k*), or any other injury.[6]
7. Each comb shall be firmly attached (*l*) to all four sides of the section.
8. In three-fourths of the combs no through holes (*m*) are permitted, except four of approximately bee size; in the remaining 25 per cent of the sections these holes may be slightly larger, or one additional hole shall be permitted. No dry holes (*m*) are permitted in the body of the comb.
9. All cells must be evenly capped (*n*), except the outside row next to the wood, and not more than 12 open cells (*o*) shall be permitted in this row. These open cells may be empty (*o*) or filled with honey.
10. Unless otherwise specified, the minimum net weight (*p*) shall be 12 ounces. See page 13.

TOLERANCES

No tolerance is permitted either for weight or for defects.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

UNITED STATES EXPORT SECTION HONEY

United States Export section honey[5] shall meet the following requirements:

1. The honey shall be free from cells of pollen, granulation, honeydew, poorly ripened or sour honey, any objectionable flavor from

[5] This is a special grade and should not be packed except on order. (See p. 15.)
[6] Weeping, bruising, or other damage developing in transit on honey otherwise up to grade shall be considered as affecting the condition, but not the grade.

the floral source, taint of smoke, carbolic acid, other foreign flavor, odor, or damage caused by other means.

2. The honey in any comb must be uniform in color (*b*). (See "Color classification," p. 12.)

3. Each section shall conform to the requirements of the official color chart (*c*) as to color of comb and cappings (*d*), freedom from excessive propolis and pronounced stains (*e*).

4. The sections shall be new in appearance (*f*) and of white wood (*g*). Unless otherwise specified, they shall be packed as described for export packing. (See p. 14.)

5. The comb shall not project beyond the wood of the section (*i*).

6. The surface of the comb must be dry, free from any sign of weeping (*j*), and from damage caused by bruising (*k*) or any other means.[8]

7. Each comb shall be well attached (*l*) to all four sides of the section.

8. In three-fourths (75 per cent) of the sections not more than 3¾ linear inches of through holes (*m*) next to the wood shall be permitted; in the remaining 25 per cent of the sections not to exceed 4¼ linear inches of through holes shall be permitted. No dry holes (*m*) are permitted in the body of the comb.

9. All cells other than the outside row next to the wood must be evenly capped (*n*), except for slight irregularities of surface (*n*) affecting not to exceed one-half of the comb surface. At least 50 per cent of the outside row next the wood must be capped. Any honey contained in open cells (*o*) in this outside row must be so heavy in body that upon arrival at destination the surface of the comb will be absolutely dry.

10. Unless otherwise specified, the minimum net weight (*p*) for this grade is 12 ounces. (See p. 13.)

TOLERANCES

No tolerance is permitted either for weight or for defects.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

UNCLASSIFIED SECTION HONEY

Unclassified section honey shall consist of sections of comb honey which are not graded in conformity with any of the foregoing grades.

TOLERANCE

In order to allow for variations incident to proper grading and handling, not more than 5 per cent of the sections by count in any lot may not meet the weight requirements, but the weight of no section shall be more than one-half ounce below the minimum net weight.

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[8] Weeping, bruising, or other damage developing in transit on honey otherwise up to grade shall be considered as affecting the condition, but not the grade.

GRADES FOR SHALLOW-FRAME COMB HONEY

UNITED STATES FANCY SHALLOW-FRAME COMB HONEY

United States Fancy shallow-frame comb honey shall meet the following requirements:

1. The honey shall be free from cells of pollen, granulation, and from damage (*a*) caused by honeydew, poorly ripened or sour honey, any objectionable flavor from the floral source, taint of smoke, carbolic acid, other foreign flavor, odor, or damage caused by other means.

2. Unless otherwise specified, the honey shall be uniform in color (*b*) throughout the combs of the lot. (See "Color classification," p. 12.)

3. Each comb shall conform to the requirements of the official color chart (*c*) as to color of comb and cappings (*d*). The frames need not be free from propolis or stains.

4. It shall be produced in combs which never have contained brood, and, unless otherwise specified, it shall be produced in combs spaced 1⅜ inches from center to center.

5. Comb foundation used shall be light in color and shall be thin enough to produce a comb that will compare favorably in texture with section honey.

6. Combs shall be well built out (*q*), well capped over (*r*), and free from broken cappings or damage by other means.[9]

7. One hundred and fifty unsealed cells (*o*), full of well-ripened honey, on any one comb are permitted in addition to open cells (*o*) in the outside row, if these unsealed cells are on the outside edges of the comb. No empty cells (*o*) are permitted except in the outside row next the wood.

TOLERANCES

In order to allow for variations, other than in weight, incident to proper grading and handling, not more than 5 per cent by count of the frames of honey in any lot may be below the requirements for the grade, but not to exceed two-fifths of this amount, or 2 per cent, shall be allowed for defects causing serious damage (*a*).

In addition to the foregoing tolerance, a variation of not more than 5 per cent below the net weight (*p*) marked on the cases shall be permitted.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

UNITED STATES NO. 1 SHALLOW-FRAME COMB HONEY

United States No. 1 shallow-frame comb honey shall meet the following requirements:

1. The honey shall be free from damage (*a*) caused by cells of pollen, granulation, honeydew, poorly ripened or sour honey, any objectionable flavor from the floral source, taint of smoke, carbolic acid, other foreign flavor, odor, or damage caused by other means.

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[9] Broken cappings or other damage developing in transit on honey otherwise up to grade shall be considered as affecting the condition, but not the grade.

2. Unless otherwise specified, the honey shall be uniform in color (*b*) throughout the combs of the lot. (See "Color classification," p. 12.)

3. Each comb shall conform to the requirements of the official color chart (*c*) as to color of comb and cappings (*d*). The frames need not be free from propolis or stains.

4. The honey shall be produced in combs which never have contained brood, and, unless otherwise specified, it shall be produced in combs spaced 1⅜ inches from center to center.

5. Comb foundation used shall be light in color and shall be thin enough to produce a comb that will compare favorably in texture with section honey.

6. Combs shall be free from serious damage (*a*) caused by broken cappings or by other means.[10]

7. Two-thirds of the combs in any lot must be free from open cells except in the outside row. Not more than one-third of the combs in any lot may have open cells (*o*) in addition to those in the outside row. The open cells, exclusive of those in the outside row, must be confined to well-defined areas, and in the aggregate must not cover more than one-fifth (20 per cent) of the comb surface of any frame. Such open cells must be full of well-ripened honey. No empty cells are permitted except in the outside row next the wood.

TOLERANCES

In order to allow for variations, other than in weight, incident to proper grading and handling, not more than 5 per cent by count of the frames of honey in any lot may be below the requirements for the grade, but not to exceed two-fifths of this amount, or 2 per cent, shall be allowed for defects causing serious damage.

In addition to the foregoing tolerance, a variation of not more than 5 per cent below the net weight (*p*) marked on the cases shall be permitted.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

UNCLASSIFIED SHALLOW-FRAME COMB HONEY

Unclassified shallow-frame comb honey shall consist of shallow frames of comb honey which are not graded in conformity with either of the foregoing grades.

TOLERANCE

In order to allow for variations incident to proper weighing, a variation of not more than 5 per cent below the net weight (*p*) marked on the cases shall be permitted.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

GRADES FOR CUT-COMB HONEY

Comb honey packed in waterproof paper and in cartons shall be graded as to color and quality in accordance with the United States grading rules for section honey.

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[10] Broken cappings or other damage developing in transit on honey otherwise up to grade shall be considered as affecting the condition, but not the grade.

Comb honey packed in tin shall have, unless otherwise specified, not less than 50 per cent of comb honey of grade equal to that specified for shallow-frame comb honey, and the total weight shall be made up with United States fancy extracted honey. (See p. 9.)

Unclassified cut-comb honey shall consist of cut-comb honey which is not graded in conformity with the requirements of either of the foregoing classes.

TOLERANCE

In order to allow for variations incident to proper grading and handling, not more than 5 per cent by count of the packages in any lot may be below the grade requirements.

NOTE.—In addition to the foregoing requirements, standards for color of honey are to be found on page 12 and for packing and marking on page 13.

GRADES FOR EXTRACTED HONEY [11]

GENERAL REQUIREMENTS

Extracted honey of United States Fancy and United States No. 1 grades shall meet the following requirements:

1. The honey shall be well ripened and free from damage (*a*)[12] caused by overheating, fermentation, honeydew, pollen, any objectionable flavor from floral source, taint of smoke, carbolic acid, other foreign flavor, odor, or dirt, or damage caused by other means.
2. The honey shall weigh not less than 12 pounds per gallon of 231 cubic inches at 60° F. (See "Density," p. 25.)
3. The color may be any of the grades of color, as measured by the standard honey grader. (See instructions for color grading on p. 26.)
4. Containers shall be strong and clean and new in appearance, and marked as required on page 10.

United States Fancy extracted honey shall, in addition to the foregoing general requirements, be at least as free from foreign materials as honey that has been strained through standard bolting cloth of 86 meshes per inch, at a temperature of not more than 140° F. (See "Clearness," p. 25.)

United States No. 1 extracted honey shall, in addition to the foregoing general requirements, be at least as free from foreign materials as honey that has been strained through standard bolting cloth of 23 meshes per inch, at a temperature of not more than 140° F. (See "Clearness," p. 25.)

United States No. 2 extracted honey shall consist of extracted honey which does not meet the requirements of either of the foregoing grades.

Unclassified extracted honey shall consist of extracted honey which is not graded in conformity with any of the foregoing grades.

TOLERANCE

In order to allow for variations incident to proper grading and handling, not more than 5 per cent by count of any lot of honey may

[11] It will be noted that the chief difference between the grades in extracted honey is in the clearness, United States fancy being ready for retail trade, whereas United States No. 1 requires further clarifying. Further information in regard to grading extracted honey is given on page 25.

[12] The letters in parentheses and following certain words indicate that these words have been further defined. (See "Definitions of terms," p. 10.)

be below the requirements for the grade, but no part of this tolerance shall be allowed for defects causing serious damage (*a*).

MARKING REQUIREMENTS FOR EXTRACTED HONEY

Extracted honey graded according to United States grading rules shall be marked as follows: Each package shall be marked with the United States grade and with the net weight of the honey in the package. If in an opaque package, the color of the honey shall also be stated.

DEFINITIONS OF TERMS

As used in these grades—

(*a*) *Damage* means any injury from the causes mentioned which materially affects the appearance, shipping, or edible quality, such as—

The presence of any cells of pollen in more than one-third of the combs in any lot of No. 1 shallow-frame comb honey. One-third of the combs may have not more than 50 cells of pollen in a comb, provided they are not widely scattered, but are on the outside edges of the comb.

The presence in section comb honey, or in No. 1 shallow-frame comb honey, of more than 10 per cent by volume of granulated honey in any open cells, or of more than very small or scattered granules in the closed cells.

The presence of any objectionable flavor from floral source. Nectar gathered from plants such as bitterweed often imparts a very disagreeable flavor to the honey, which materially injures its quality.

The presence of any spots of feces (bee excrement) on the comb.

Serious damage means any injury which seriously affects the edibility or the shipping quality. Any spots of feces on the surface of the comb, or, in sections, attachment of less than 45 per cent of the possible area of attachment, shall be considered as serious damage.

(*b*) *Uniform in color* means that on looking through a comb toward the light no pronounced variation in color is apparent in the honey.

Fairly uniform in color means that honey of a slightly different color from that in the body of the section is permitted in the outside row next to the wood and in 10 additional cells, provided that these additional cells are well distributed and are in the row adjoining the outside row. In no event shall the contrast of color be greater than that between any grade and the second following grade on the extracted-honey grader. A contrast as great as that between buckwheat honey and clover honey is not permitted, nor shall any dark honey that will spoil the flavor of the honey in the body of the section be included.

(*c*) *The official color chart* is a lithographed card showing sections of comb honey of the different grades. It shows the lowest limit of color of comb surface in a grade, and not the grade average. This card will also be useful in determining the general appearance of a section that is well or firmly attached within the meaning of the grade. It is not supplied with the grading rules. (See p. 17, footnote.)

(*d*) *Color of comb and cappings.*—Color of honey in the lighter grades affects the surface appearance of the comb very little unless

the cappings are more or less watery in character, in which case the amber-colored honeys do cause considerable change in appearance of comb surface. Therefore the general appearance of the comb must be considered, and not merely the actual color of the cappings. In the preparation of the color charts this fact has been considered.

"*Watery*" *or* "*water-soaked*" cappings are apparently thin or somewhat translucent, the cells frequently being filled so full of honey that no air space, usually to be found, is left between the honey and the capping.

(*e*) *Freedom from excessive propolis* means that the top of the section shall bear no greater stain from propolis than that which is ordinarily found on a paraffined section (see "Paraffining tops of sections," p. 16), and that the other three sides and the edges and inner faces and angles of the sections shall be scraped as reasonably free from propolis as possible without cutting into the wood of the section or damaging the comb. Permissible stain will be shown on the color charts. "*Propolis*" is gum gathered by the bees from a variety of plants, but especially from waxy or sticky buds. It varies much in color, and is responsible for most of the color on the wood of sections and on the comb itself.

(*f*) *New in appearance* shall mean not discolored by age or exposure. Clean, used cases, or cases from a previous season are permitted if they appear new, as they sometimes do after they have been properly sandpapered. Paraffined sections (see "Paraffining tops of sections," p. 16) usually appear new, even though they may be left over from a previous season.

(*g*) Sections shall be of *white wood*. Sections which damage the appearance of a fine grade of honey, such as those of a buff color, or white sections with other than very small dark knots or streaks, are not permitted except as stated for No. 1 and No. 2 grades.

(*h*) *Well packed* shall mean packed in fiber cases as described for export packing (p. 14), or in double-tier or single-tier wooden cases. Wooden cases shall have a "drip sheet" of kraft or other strong paper in the bottom of the case, and above that a sheet of corrugated fiber board with the corrugated side up. If a double-tier case is used a drip sheet and corrugated board shall be provided between the two tiers of sections, and also a corrugated board and a sheet of paper as covering above the sections. (See "Packing and shipping honey," p. 20.)

(*i*) *Comb not projecting* beyond the wood of section. This refers to the projection of comb beyond the widest part of the wood, generally because no separators were used, and does not refer to the occasional slight projection of wax beyond the narrow or beeway part of the section. Projection at this point to such an extent that honey leaks down over the face of the comb is not permitted.

(*j*) *Weeping* is the exudation or seepage of honey through the cappings, forming small drops which finally run down the face of the comb. It is caused by absorption of moisture from the atmosphere by the honey.

(*k*) *Bruising* is any injury by accident or pressure, such as an indentation of the surface of the comb by pressure of the fingers. Bruising is a damage if it is sufficient to cause leaking.

(*l*) *Well attached* means that at least one-half (50 per cent) of the "possible area of attachment" must be attached to the wood. *Firmly attached* means that at least three-fourths (75 per cent) of the possible area must be attached. *Possible area of attachment* means the total length of the four inner sides of the section multiplied by the thickness of the comb, as, for instance, in the case of a section 4¼ inches square, 4+4+4+4=16, which, multiplied by the actual thickness of the comb, which might be 1¼ inches, gives a possible area of attachment of 20 square inches. (See "Attachment of comb to wood of section," p. 19.)

(*m*) *Through holes* are holes or passages through the comb from one side of the comb to the other, between the edge of the comb and the wood of the section. Dry holes are holes in the honeycomb larger than the size of a cell, and not next to the wood; they may extend partly or entirely through the comb.

(*n*) *Evenly capped* means that the surface of the combs shall be free from irregularities other than those incident to the work of the bees in completing a comb of uniform construction. Wherever a statement is made that *slight irregularity* may be permitted, it shall mean an irregularity of not more than one-eighth inch above or below the general surface of the comb, but not projecting beyond the wood, the proportion of irregularity being as specified for the grade in question. The slight ridging of comb surface sometimes incidental to the use of fence separators is not to be considered an irregularity.

(*o*) *Open cells* means either unsealed or empty cells. *Unsealed* or *uncapped cells* are any cells containing honey which are not entirely sealed, including cells which have been cut open by the bees. *Empty cells* are those which do not contain honey.

(*p*) *The net weight* of a section shall be its actual weight less an allowance of 1 ounce for the wood of the section, which shall not weigh more than 1 ounce. *Minimum net weight* is the net weight of a section of the lowest weight permitted in a grade, and is the weight which is to be marked on each section in the case. In shallow-frame honey the net weight is the net weight of the package, obtained by deducting the weight of the case and frames from the gross weight.

(*q*) *Well built out*, as used under shallow-frame honey, means that the combs are fairly uniform in thickness throughout each comb and throughout the lot.

(*r*) *Well capped over* means that the surface of the combs shall be free from any irregularity or imperfection that will materially interfere with the handling and packing of the honey in glass or tin, or that will materially damage the appearance of the honey when it has been placed in containers.

COLOR CLASSIFICATION FOR COMB HONEY

1. In addition to the foregoing requirements for section honey and shallow-frame honey, comb honey shall be classified by color as white, light amber, amber, or dark amber.

The foregoing color classification shall be determined by the standard color grader for extracted honey described on page 30, and the grades shall be designated as follows:

(*a*) Honey classed as water white, extra white, and white by the grader shall be designated White comb honey.

(*b*) Honey classed as extra light amber and light amber by the grader shall be designated Light Amber comb honey.

(*c*) Honey classed as amber and dark by the grader shall be designated Amber comb honey.

(*d*) Buckwheat and other similarly dark honeys which are darker than the limit of the extracted honey grader shall be designated Dark Amber comb honey.

In making a color test a sample of honey shall be drained from a broken comb and the liquid honey tested.

2. If comb honey is being sold to a special market which requires honey of a particular shade, it is permissible to state the exact shade of color of the honey contained in the comb in conformity with the colors established for the grading of extracted honey; to give its reading on the graduated scale of the color grader; and to give any other accurate description desired. It is, however, not usually desirable in commercial grading of comb honey to use color terms other than white, light amber, amber, and dark amber.

PACKING AND MARKING REQUIREMENTS FOR COMB HONEY

COMB HONEY IN SECTIONS

Comb honey in sections, graded according to United States grading rules, shall be marked as follows: Each section or carton shall be stamped or labeled with the minimum net weight of the section, its United States grade, and the color of the honey. The stamp or label used on sections shall also be placed on both ends of each shipping case. Unfading black ink shall be used with all stamps. All lettering on packages of honey graded according to the United States grading rules shall be plain and of such a character as to be read easily.

Examples:

United States Fancy White Net weight 12 ounces or more	United States Mixed Color No. 1 Net weight 11 ounces or more

Light-weight sections which meet all requirements for a certain grade, but which are too light in weight, may be packed in separate cases and shall be marked with the specific weight.

Example:

United States
11-ounce Fancy White
Net weight 11 ounces or more

Heavy-weight sections may also be packed separately and marked with the specific weight.

Example:

United States
14-ounce Fancy White
Net weight 14 ounces or more

It will be noted that, unless otherwise specified, only one minimum net weight is provided for each grade. This is in the interest of simplicity in grading, much labor being required if each section is marked with its exact weight. In most markets cases with sections

well assorted as to weights are satisfactory, provided the net weights of cases are fairly uniform. For some markets assorting of sections of approximately the same weight into separate cases is advisable. Such assorting as to weights should be done only when the packer knows that it is desirable. The packer should know his market and then pack to suit it.

Unless otherwise specified, United States Exhibition and United States Export section honey shall be packed with the different weights, as 12-ounce, 13-ounce, etc., in separate cases, and the sections and cases shall be marked accordingly.

Unless otherwise specified, the United States Export grade is to be packed in strong, 24-section, corrugated fiber cases, with partitions one-fourth inch higher than the section in its carton, making a separate compartment for each section. Each section is to be encased in a separate carton before being placed in the compartment provided for it. Eight of these cases are to be packed in a standard comb-honey carrier, which shall first be lined with kraft paper or with double-texture waterproof paper. Carriers shall be large enough to provide for at least 4 inches of straw under the cases and 2 inches of straw at sides and top. The carrier is to be well nailed with cement-coated nails, wired or strapped, and provided with cleats nailed on two sides near the top, projecting 4 inches at each end so as to provide handles for moving the carrier.

If so specified, wood cases, preferably double tier, packed in carriers as above described, may be used for United States Export grade.

SHALLOW-FRAME COMB HONEY

Shallow-frame honey, graded according to United States grading rules, may be shipped as it is produced by the bees. Frames and cases for both grades of this honey must be well made and of neat appearance. Tops and bottoms of cases shall be lined with kraft paper.

Each super or case of frames of shallow-frame honey shall be marked with the United States grade, with the color of the honey, and with the net weight of the package, obtained by deducting the weight of case and frames from the gross weight.

CUT-COMB HONEY

If less than 50 per cent of comb honey is used in making the pack in tin, the percentage used shall be stated on the label.

Cut-comb honey packed in glass may be inspected readily, and no marking requirements are at present considered necessary regarding the percentage of comb and extracted honey in such containers.

To comply with the Federal pure food laws, each package must be marked with the net weight.

Comb honey packed in waterproof paper and in cartons, and graded as to color and quality to comply with the United States grading rules for section honey, shall be marked as specified for section honey.

UNCLASSIFIED

Unclassified honey shall be marked "Unclassified, net weight ——— or more."

THE PRACTICE OF GRADING COMB HONEY

GRADES AND THE MARKET

Comb honey destined for the wholesale market should be, unless on special order, of two grades: United States Fancy and United States No. 1.

United States Fancy should be a large class. It will contain, depending on the season and on the skill of the beekeeper, from 25 to 60 per cent of the total merchantable honey, the remaining 75 to 40 per cent being of No. 1 grade. Although the Fancy grade should be a strictly high-grade product, the grading requirements for this class should not be such as to cause any great loss of food value in producing it. It should be such a grade as can be produced economically under best commercial practice.

United States No. 1 is somewhat less in weight and slightly inferior in finish to Fancy, but is its equal in edible quality.

United States No. 2 is decidedly inferior to Fancy and No. 1, and should never be shipped to the wholesale market if it is possible to avoid it, but should be sold locally. On a local market a fair price for this grade can be realized, whereas the wholesale price is rarely sufficient to pay the cost of production.

United States Exhibition and United States Export grades are special grades, which should never be packed by a producer except on special order. Both these grades are of such a class that it costs the beekeeper, under usual conditions, more to produce them than the Fancy and No. 1. He can not afford to produce and grade them out of his stock except on special order, at a corresponding advance in price. On the ordinary market these grades rarely sell for any more money than the Fancy grade.

United States Exhibition grade is a class, superior to Fancy only in finish, for particularly well-finished sections which, in some parts of the country, can scarcely be produced with profit, while in other places a certain proportion of honey of this grade can be produced profitably if a high price is offered. It is intended to include in this grade only honey of the highest quality as to finish that can be produced.

The three grades, Fancy, No. 1, and No. 2, will include all the comb honey produced, except a small percentage which should be regarded as culls. Certain specially selected lots will meet the "exhibition" requirements, and may sell at a correspondingly higher price. However, as has been stated, the producer seldom realizes this extra price. He usually finds it not worth while to grade any exhibition stock.

United States Export grade is comparable to Fancy, except that it is intended to be as free as possible from leakage or injury under the conditions to which it is subjected in ocean transit. In finish it is in some respects not the equal of Fancy. Like the Exhibition grade, it should be packed only when the price offered is sufficiently high to warrant it.

THE PURPOSE OF GRADING

Grading rules are established to secure uniformity in the methods of grading and packing, thereby making it possible to put on the

market from different honey-producing regions a product as nearly uniform as possible in color, finish, weight, and quality.

Much honey is sold in markets distant from its place of production, and unless the buyer in a distant city can be definitely informed how a certain lot of honey is graded and packed, he is not in a position to judge whether the price quoted will justify the acceptance of the offer. Uniform grading rules, strictly enforced, are therefore essential for the establishment of desirable relations between buyer and seller and to insure prices satisfactory to the producer.

Although it seems necessary to include in this circular considerable matter other than the actual rules for grading, it is believed that the pages devoted to grading rules will be found clear and compact enough to be used without undue effort. In actual practice the honey producer in any particular region will use only a limited portion of the circular, and pay no attention to the parts not applying to his locality, but which are necessary for other regions which produce honey having different characteristics.

It is not to be expected that the grading rules as here formulated will be the final word in grading honey. Actual experience with the rules will undoubtedly suggest changes and amendments, which can be embodied in later editions of this circular. The important thing is that these rules should be used, and should be adopted and enforced by the States. They should not be considered as complete, but as the working basis for perfecting a set of rules that are thoroughly practicable.

Both the demand and the need are great for uniform standard United States grading rules for honey. Neither slight dissatisfaction with the new rules nor the difficulty of grading according to other rules than those to which one is accustomed should deter anyone from cooperating with all other beekeepers and honey graders in an effort to secure a workable set of grading rules.

PARAFFINING TOPS OF SECTIONS

As this circular is not primarily designed to aid in producing honey, the only point in production which is touched on is that of paraffining sections. This practice is referred to in the grading rules and is believed to be, both from an economic standpoint and as a means of increasing the attractiveness of comb honey to the consumer, of such importance as to deserve special attention. It is strongly recommended to all producers of comb honey.

This use of paraffin is an old practice, said to have been originated by Harry R. Warren, of Nevada. Although paraffining is largely used in the West, and to a limited extent in the East, it has not become a general practice. It is of such great importance, both to the beekeeper and in promoting the good appearance of cases of honey, that it ought to be universally followed. If paraffining is done properly very little propolis will be deposited on the tops of sections, and what is placed there can be scraped off readily, leaving the sections practically free from stain. The cost of paraffining is probably less than three-fourths of a cent per case, and the labor saved in scraping sections is worth much more than that. Again, unused paraffined sections are practically as good, even though kept over for a season, as when first put up, not becoming dirty and

discolored. Those who use bait sections will also find paraffining very valuable.

HOW TO PARAFFIN TOPS OF SECTIONS

Only paraffin of the best grade and the highest melting point should be used. Paraffin of low grade discolors at a temperature too low to permit good work and imparts a greasy appearance to the top of the section. Take a pan of hot paraffin (its temperature should be 180° to 190° F.) and an ordinary varnish brush. Give a thin, smooth coat to the tops of the sections after they are in the supers and before they are given to the bees. The brush when not in use must be kept continuously in the hot paraffin. Just before it is applied to the sections it is to be wiped off on the edge of the pan to remove the drip, then it is given one sweep lengthwise over the tops of four sections. The brush must not be worked back and forth, for that will cause air bubbles and make an uneven surface. Supers should be tilted up to an angle of 45°, and the brush given only one sweep down. This will greatly aid in preventing bees from depositing smears of propolis over the tops of the sections. If the paraffin is at proper temperature and the work is well done, enough paraffin will enter the spaces between the adjoining sections almost to prevent the deposition of propolis on the upper edges of the vertical ends of sections.

HOW TO GRADE COMB HONEY [13]

Grading comb honey must be done in a well-lighted place but not in direct sunlight. A well-ventilated and screened room with one or several windows is ideal. Bees, flies, and other insects must be kept out of a room where honey is being packed. Because of the transparency of honey no grading should be done by artificial light or by strong sunlight. Five hours of steady work is as long as the average person can grade honey accurately; therefore it is well to select the hours when the light is best.

A large bench or table is needed, to have plenty of room for the work and for placing shipping cases in which to pack the various grades.

It will be found convenient to mark each case, as it is put in its proper place on the grading bench, with a mark indicating the kind of honey which is to be placed in the case. The following markings, placed in the handhole in each end of wooden cases, are in use and are convenient:

For Fancy grade, mark an X in handholes.
For No. 1 grade, use a dash, —.
For No. 2 grade, use two vertical lines, ||.

The use of such markings frequently prevents errors, which sometimes arise when the grader leaves a partially filled case to be completed later. It is also a convenience in that separate piles of the different grades or color divisions of the same grade may be made as

[13] The official color chart, which is essential to grading honey according to the United States standard grades, will be supplied separately from the grading rules. It may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a cost of 15 cents.

the cases are filled. Then at his convenience the grader or his helper may stamp or label the cases uniformly as desired.

It is absolutely necessary to have enough cases on the bench to enable honey of the same shade and finish to be cased together. The mixing of different-colored sections in a case is not to be tolerated where there is much color variation. Uniformity is most easily obtained by placing each section, after cleaning propolis from the wood, in a pile with other sections of its grade. Uniform sections may then be selected from the pile for each case.

If possible one person only, with a good eye for color, should do the grading of the crop, in order to obtain uniformity and to place on one person the responsibility for this work.

The grader should keep the color chart representing the various grades always before him, upright on a shelf within easy reach, in a good light, and in such a position that comparison may be made easily between the card and the section being graded. It should be a strict rule that any doubtful section should be put into the grade below. This not only increases the value of the upper grade but of the lower grade as well, and the producer will be well repaid for placing in the lower grade the few doubtful sections in his honey crop.

TOLERANCE

It will be noted that tolerances have been specified in connection with the grades for honey. This may need some explanation in order to avoid misunderstanding on the part of those who are not familiar with the work of inspectors. Grading rules require that the inspector must live up to the letter of the requirements. Without tolerance the occasional error of a packer or a grader in vision or in judgment can not be taken into consideration by an inspector, who must judge the honey as he finds it. The tolerances are therefore given "in order to allow for variations incident to proper grading and handling." This does not mean that a grader may *intentionally* admit to a grade any honey which he knows to fall in quality below the grade requirements, but is intended to cover the *unavoidable* errors that the grader will make, even though he tries his best to grade according to the rules. Even when every endeavor is made, as it must be, to keep within the grade, enough faults will creep in to make some tolerance necessary.

Inspectors readily learn to judge very correctly as to the honesty with which a grader is interpreting the rules. If any lot of honey shows throughout the cases a near approach to the permitted tolerance, the inspector doubts the sincerity of the grader. If only an occasional section or case is found to be faulty, the inspector will consider it a just case for the application of tolerance. If, for instance, out of a lot of 100 cases of Fancy section honey 5 cases are distinctly below the grade and should be in No. 1, an inspector would consider this not due to "variations incident to proper grading and handling," but an attempt at fraud.

SURFACE COLOR OF COMB HONEY

It is usually of considerable importance that the assorting of surface finish into different colors within the grade be carefully

observed. It is not recommended, however, that these divisions be made in all instances. No division should be made unless the variation of color within a grade is pronounced. If a beekeeper does not find his region producing a variety of colors within a grade he need not complicate his work by attempting to make a divided grade. There are regions where only one color surface to a grade will be produced, but there are other places where, owing to the length and slowness of the honey flow, the collection of much propolis, or some other reason, the surface of many combs is stained to a greater or less degree. In some regions, also, much honey is produced that has "watery" or "water-soaked" or "greasy" cappings; that is, while the honey itself is uniform in color with the honey in sections that may be white in surface color, the cappings seem to be thin, or are so close to the honey as to appear somewhat transparent, destroying the fine appearance of the honey.

In some parts of the country such darker-appearing honey sells at as good a price as the whitest, while in other markets a great reduction in price must be taken. Care should, therefore, be used to have all the combs in any case uniform in surface color. In the Fancy grade probably not more than two color divisions will ever be needed, whereas in the No. 1 grade as many as four surface-color divisions are sometimes necessary to care for irregularities in color and in "watery" combs.

ATTACHMENT OF COMB TO WOOD OF SECTION

As the shipping qualities of section honey depend in large measure on the firmness of attachment to the wood, this is one of the items which should be constantly in mind when grading honey. This firmness depends on the percentage of attachment in two respects: (1) The area of attachment, and (2) the linear attachment. The area of attachment is found by estimating or measuring the area of the portions of the comb attached to the wood and finding what percentage this is of the possible area of attachment if the comb were built out evenly to the wood and fully attached all around the inside of the section. Although the exact area of attachment can be determined accurately only by measurement of attached areas, it will not be necessary to measure attachment except occasionally, in order to determine definitely and to become familiar with the appearance of sections which are "well attached" or "firmly attached." Observation of the work of expert honey graders has shown that they pass into the shipping grade all sections which have as much as 50 per cent of the total comb area attached, provided that other grade conditions are complied with. A few sections having not less than 45 per cent of comb area attached are occasionally admitted to the shipping grade if they are otherwise so exceptionally finished as to make them safe to ship. A tolerance of 5 per cent has been provided on attachment to cover such cases, although the grader, as on other points, should put into the next lower grade any section which is in any way doubtful.

The "linear attachment" is specified by giving the inches of through holes permitted in any grade. As in other points, a tolerance is provided to facilitate proper grading.

FLORAL SOURCE

No requirements as to floral source, except as to freedom from generally recognized disagreeable flavor, are made in the United States grading rules for honey, this matter being left to the discretion of the various States. In assigning the grade of honey it is not required that the floral source be marked on the case, though it is usually desirable that the floral source should be stated when describing honey to the buyers. The flavor named should be the predominating flavor or flavors, the dominant flavor being named first if the honey is a mixture from several floral sources. For instance, the source may be sweet clover-alfalfa or alfalfa-sweet clover, depending upon which flavor is most pronounced.

Some confusion has arisen between honey from white clover and from the white sweet clover. Care should be taken, when the floral source is one of the two, to state clearly whether the honey is from white clover or from sweet clover.

PACKING AND SHIPPING HONEY

It is common knowledge that comb honey is fragile and that great care needs to be exercised in shipping it. Most of the comb honey shipped in carload lots, if carefully packed in the car, is in fairly good condition when it reaches the railway station to which it is consigned. The great loss occurs in shipping comb honey in small lots or in rehandling and trucking it from the car to the broker and retailer. Much of this loss can be prevented by the use of better cases and better methods of packing.

Evidence apparently indicates that the partitioned case made of corrugated fiber board is the best case for local use, provided it is sufficiently well-made. Each section is in a compartment by itself and is well protected. This case is unsatisfactory, however, if cartons are not used for the individual sections before the latter are placed in the compartments. Without cartons there is almost a certainty of some breakage or leakage. The honey then cements the section to the paper of the case, making it difficult to remove leaky sections or other unbroken sections to which the honey may have traveled. Cartons are an additional cost, but the paper cases, even with the added cost of cartons, are cheaper than wooden cases. With each section in a separate carton, any leakage is usually confined to the section that is leaking.

For car-lot shipment, and for handling without carriers in warehouses and in trucking, corrugated cases become soiled and unsightly more easily than wooden cases. They are subject to the objection that they are more troublesome to close perfectly after being opened for examination than are the wooden cases.

Since probably 25 per cent of all comb honey shipped reaches the retailer in a more or less broken condition, it is most important that the original packing be good enough to prevent this. It is doubtful if there is any one thing that so disgusts a retailer with handling honey, and that hurts the market so much, as the broken, leaky mess which all too often comes to the retailer as a case of comb honey.

Although every care should be taken when grading honey to include in the unsealed cells no honey that will leak out or readily

absorb sufficient moisture to run down over the face of the comb, the best possible grading will not be sufficient to offset poorly constructed shipping cases.

In the course of this investigation of comb honey perhaps all sorts of cases have been seen. None of them will thoroughly protect comb honey from breakage when they are handled as this product is commonly handled by truckers and others who are not familiar with its fragility. Since we can do little to change conditions in regard to rough handling, it seems best to use every effort to devise such cases and packing as will reduce breakage to a minimum. As railway and express companies have to pay so many claims for damaged honey, freight and express rates are made high enough to take care of this breakage. Those beekeepers who ship honey without breakage are, consequently, paying in high freight rates the losses claimed by those whose honey is broken in transit. It is not too much to say that 90 per cent of the shipments of honey in small lots out of New York are followed by claims for breakage. In the end the beekeeper or the consumer pays these losses.

The railroads now bar section honey from express shipment if it is put up in fiber-board cases, unless these cases are also incased in wood and the wood cases cushioned inside at the bottom with straw. Shipments by freight must also be packed in this way to comply with the requirements of the railroads. This regulation was made because some beekeepers used poorly made fiber cases lighter than the regulation weight.

One frequent fault with shipping cases is that they are made so shallow that when corrugated cardboard is placed in the bottom of a case the sections are flush with, or even above, the top of the case so that when the cover is on it is solidly on top of the sections. Cases so packed sometimes arrive at their destination with almost every comb broken down. All cases should be so large that the sections will fit in loosely, not needing to be crowded into place. No follower is necessary or desirable in wooden cases if they are of proper size for the sections used. If followers are used at all they should be no more firmly held than by supersprings or by paper stuffed in loosely. Solid paper wads should never be packed tightly behind the follower: the sections should be free to move a little, so that they may shift slightly with any shock, and thus prevent the shock from being transmitted directly to the combs themselves. Instances have been known where sections fitted within the case so closely that they could not be removed until the sides of the case had been partially pried off. The most badly broken honey observed was shipped in such a case.

If it were possible always to handle comb honey in carriers the problem could be settled easily, as the standard carriers holding eight cases prevent nearly all breakage. Trouble comes, however, when honey is handled in less than eight-case lots, as is often necessary, since many retailers order only a case or two of honey at a time. Breakage is all but a universal occurrence if cases are delivered singly without other protection than the usual shipping case. This breakage is one of the greatest factors in the growing unwillingness to handle comb honey. Breakage appears to be an even greater factor of dissatisfaction than the common practice on the part of a producer of including in a shipment cases of honey which he knows to be of a

lower grade than the honey which he agreed to sell. A recent instance of the latter which the writer has in mind is a carload of comb honey sold as Fancy and No. 1 in which, besides the poor grading in most of these Fancy and No. 1 cases, there were a number of cases of No. 2 honey, not indeed end-marked on the cases as No. 1 or Fancy, but bearing no mark other than the one used by the shipper for his own convenience to indicate the grade of honey in the case. This car of honey, aside from its poor grading, arrived at its destination in good condition, with little breakage. Breakage would begin with distribution from the car to the broker's warehouse, out of the truck, upstairs to the storerooms, down again when a few cases are sold, on a hand truck to the street, on a motor truck through rough streets, then off the truck again to the sidewalk, and trucked again into the retail store. No one can tell when or by whom the honey was broken. It is impossible to have an expert honey handler accompany every shipment and be present at every transfer, and therefore the rough handling can not be pinned down to any individual. In the end the retailer has a broken mass of honey on his hands, and often must sell so much of it at a discount that all profit on handling the case is gone. He may put in a claim for breakage to somebody and in time get a refund, which seldom pays him for his time and trouble and never pays him for his annoyance. The result is that he does not willingly handle honey. Just here is one of the great reasons why all beekeepers should sell all the comb honey possible to grocers in their own and near-by towns, where they can themselves place the honey on the grocer's shelves or in his storeroom. This personal contact with the retailer induces in him a spirit of readiness to sell honey rather than an aversion to handling it. Not all honey, however, can be sold by the producer direct to the retailer or consumer, and the unsold remainder should be so packed and handled that it will reach the ultimate consumer in the condition in which it left the hands of the producer. This makes necessary the development of better methods of packing than are now in use.

It is acknowledged by all that the use of cartons would help greatly in preventing breakage, but most beekeepers feel that they are not in a position to have returned to them the additional cost of packing in cartons. It is probable, however, although this can not be said with certainty until extensive tests of various cases and methods of packing have been made, that the use of cartons and of a case that will carry honey safely will lessen breakage and excessive shipping costs to such an extent as will more than offset the additional expense of good packing. As soon as possible additional work will be done on this problem. Each packer should meanwhile use every available means to insure safe shipping. At present no shipper can be sure that a case of honey will arrive safely at its destination unless it is personally delivered or is packed in a carrier with straw around it.

For most markets the double-tier, glassed-front, 24-section case is most desirable, and in some instances, on the Pacific coast, a bonus is paid on honey in such cases. This case is less expensive, more compact, and easier to handle than the 24-section single-tier case. It is also stronger, and honey in it is not injured by any twisting or springing of the case, as sometimes occurs with single-tier cases. Six sections in the double-tier case can be seen behind the glass, as against

four in the single-tier case. This is an advantage at present, though if grading and packing are so adequately standardized that a consumer will accept a section of honey in a sealed carton, as he would a pound of butter or a carton of breakfast food, the use of glass will not be advantageous and one of the objections to the use of fiber cases will be removed.

Double-tier cases are in almost universal use except in the East, where single-tier cases are preferred. The strongest reason for using the single-tier case in the East apparently is that it makes a distinctive pack for eastern honey, as against the western honey which competes with local honey in the large city markets.

In order to simplify shipping and distribution, it would be desirable to use only one kind of shipping case throughout the United States, just as the use of one style of section is desirable. Perhaps it will be desirable to use one style of case for personal delivery by the producer to the retailer and another case for shipping and export. For export the double-tier case is at present preferred to the single-tier case.

In using double-tier cases a sheet of strong kraft paper should be provided for a tray in the bottom of the case, a margin of approximately one-half inch being turned up at each edge. This can easily be placed in the case if the sheet of corrugated cardboard of proper size is laid upon the paper and the whole then pushed down together into the bottom of the case. The corrugated side of the board should always be uppermost, so that any leaking honey may go into the grooves and not cause the sections to adhere tightly to the paper, as would be the case if the smooth side were uppermost.

After the first tier of sections has been put into place and stamped with the net weight, another kraft paper tray with corrugated paper on top is pushed down into place and the second tier of sections put in. After this top layer of sections has been stamped a sheet of paper of the exact size to fit inside the case should be laid on top of the sections and another sheet of corrugated paper placed on top of the paper before nailing on the lid. This top sheet of paper, as already remarked, should fit inside the case without extending over its edges, as any overlapping will not only have an untidy appearance, but when removing the top, as for examination of the honey in the case, the paper will be held to the top and will be torn, or it can not be replaced easily when the wooden cover is again nailed on. This matter of paper of the exact size needed is a little thing, but examination of many cases has shown it to be important.

The case should be strongly nailed together with cement-coated nails, though smooth nails are preferable for nailing on the top, the essential point being that, in order to facilitate examination of the honey and subsequent replacing of the cover in good condition, it must be possible to remove the cover readily without splitting it. Instances occur of the use of smooth nails for nailing on the bottom of the case, with the result that the whole bottom drops off while a case is being handled, naturally with disastrous results to the honey.

Some producers use double-tier cases without glass. Others place strips of veneer in the spaces provided for the glass, but the desirability of this substitution is questionable. If display cases other than shipping cases are provided for the retailer, all-wood cases serve

a good purpose and are less expensive. If a display of honey is made by a retailer when he has no display case and no shipping case with glass front, he all too often places sections of honey on counter or shelf, where they soon accumulate dust and become unsightly, and are a hindrance to selling instead of being a drawing advertisement.

There is no question but that every retailer of comb honey should be supplied with a display case in which sections may be placed secure from dust and flies, and where leaking honey will not be left on a counter or a shelf to disgust him with this line of goods. Whether the display case should be supplied by the producer, the broker, or the retailer himself remains to be decided. Such display cases will be particularly necessary if sections of honey are to be sold in sealed cartons and in fiber cases; a few sections may be removed from the cartons and put in the display case, while orders may be filled with sections that are yet in cartons.

DEFINITION OF HONEY

The following definitions of honey are contained in Circular 136, Office of the Secretary, United States Department of Agriculture, "Standards of Purity for Food Products," on page 11:

1. Honey is the nectar and saccharine exudations of plants, gathered, modified, and stored in the comb by honeybees (*Apis mellifica* and *A. dorsata*); is lævo-rotatory, contains not more than twenty-five per cent (25%) of water, not more than twenty-five hundredths per cent (0.25%) of ash, and not more than eight per cent (8%) of sucrose.
2. Comb honey is honey contained in the cells of comb.
3. Extracted honey is honey which has been separated from the uncrushed comb by centrifugal force or gravity.
4. Strained honey is honey removed from the crushed comb by straining or other means.

FEDERAL PURE FOOD LAW REQUIREMENTS FOR HONEY

1. All honey going into interstate commerce must be stamped with its net weight, as required by the Federal pure food laws, which are contained in Circular 21 of the Office of the Secretary of Agriculture, and in Circular 136, Office of the Secretary, "Standards of Purity for Food Products." Both these circulars may be obtained from the Department of Agriculture on application. The parts relating to honey are as follows:

The provisions of the act apply to foods and to drugs which have been shipped or delivered for shipment in interstate commerce, or which are exported or offered for export to foreign countries, or which are being transported in interstate commerce for sale or have been transported in interstate commerce, or which have been received from a foreign country, or which are manufactured, sold, or offered for sale in the District of Columbia, Territories of the United States or insular possessions.

Except as otherwise provided by this regulation, a package of food shall be plainly and conspicuously marked with the quantity of the contents in terms of weight, measure, or numerical count on the outside of the container, or of the covering of the package usually delivered to the consumer.

The following tolerances and variations from the quantity of the contents marked on the package shall be allowed:

Discrepancies due exclusively to errors in weighing, measuring, or counting which occur in packing conducted in compliance with good commercial practice.

Discrepancies in weight due exclusively to differences in atmospheric conditions. [The remainder of this paragraph does not apply to honey.]

In any of the States which require the marking of net weight care should also be taken to conform to the State laws.

Extract from Circular 136, "Standards of Purity for Food products":

Suitable containers for * * * honeys * * * contain on their surfaces, in contact with the food product, no lead, antimony, arsenic, zinc, or copper, or any compounds thereof, or any other poisonous or injurious substance. If the containers are made of tin plate they are outside soldered and the plate in no place contains less than one hundred and thirteen (113) milligrams of tin on a piece five (5) centimeters square or one and eight-tenths (1.8) grains on a piece two (2) inches square. The inner coating of the containers is free from pin holes, blisters, and cracks. If the tin plate is lacquered the lacquer completely covers the tinned surface within the container, and yields to the contents of the container no lead, antimony, arsenic, zinc, or copper, or any compounds thereof, or any other poisonous or injurious substance.

The standard containers on the market are intended to comply with the foregoing specifications. In these grading rules the instructions given for marking comply with the requirements of the law as here quoted.

GRADING EXTRACTED HONEY

Extracted honey is to be graded according to quality, including clearness, density, floral source, and flavor, and according to color.

CLEARNESS

The clearness of honey shall be determined by straining a sample of approximately 4 ounces at a temperature of not more than 140° F. through standard bolting cloth of the mesh specified for each grade. It is not specified that honey shall be strained or cleared in any particular way, and it is not expected that any honey, except an occasional test sample, will be strained through bolting cloth. Honey produced under the best commercial conditions should readily pass the required tests. *Foreign material* in honey means substances other than honey, such as wax, propolis, bees, parts of bees, or dirt.

Small pieces of bolting cloth, with instructions for use, may be obtained for a small sum from dealers in bee supplies.

DENSITY

It has been definitely established in the trade that not less than 12 pounds per gallon of 231 cubic inches at 60° F. is the standard weight for honey. The usual Baumé hydrometer, graduated from 0° to 50°, may also be used in determining the density, although there is some difficulty in using the instrument in a liquid as dense as honey. The Brix hydrometer is also satisfactory and is preferred by many.

The density is measured by floating the hydrometer freely in the honey. The point on the scale at which the instrument comes to rest indicates the density. It will be noted that the surface of the honey is curved upwards at the point of contact with the hydrometer. The correct reading of this instrument is on a line with the general surface of the honey, and not at the upper edge of the curved portion.

The temperature at which Baumé hydrometers are standardized is 60° F., unless otherwise marked on the stem of the hydrometer. For correct readings the honey should be brought to this temperature.

A honey of standard density has a Baumé reading of 40.9° or a Brix reading of 75.1°; but the density of honey is usually greater than the standard, many American honeys reading as high as 44° on the Baumé hydrometer or 83° on the Brix.

FLORAL SOURCE

No requirements as to floral source, except as to freedom from damage by any generally recognized disagreeable flavor, are made in the United States grading rules, this matter being left to the various States. It is not required that the floral source be marked on the package, though it is usually desirable that the floral source be named when describing the honey to a buyer. The predominating flavor or flavors should be specified, the dominant flavor being named first if the honey is produced from several floral sources. For instance, sweet clover-alfalfa or alfalfa-sweet clover, depending on which flavor is most pronounced. Some confusion has arisen between honey from white clover and that from white sweet clover. In such a case care should be taken to state clearly from which source the honey is derived.

COLOR GRADING OF EXTRACTED HONEY

Extracted honey shall be graded as to color into Water White, Extra White, Extra Light Amber, Light Amber, Amber, and Dark. The standard honey grader is supplied with a graduated scale, as well as with the grade divisions. In many instances honey can be described more accurately and sold advantageously by using the color number as read on the graduated scale instead of or in addition to the color grade. This graduated scale can be used to advantage by bottlers and others in making the exact blends required for their trade, and in procuring honey of the color necessary to make such blends.

INSTRUCTIONS FOR USING THE STANDARD GRADER

In using a grader of this type the sample of honey to be graded is placed in the wedge-shaped trough, the movable plate of the instrument being then shifted to right or left by means of the rack and pinion until the sample as viewed through the slot is of exactly the same shade as the glass below it. The pointer then indicates the grade (fig. 1).

A sample of honey the reading of which falls between the lines bounding any grade is to be considered as of that grade. If, however, in reading any given sample the pointer falls exactly on the line dividing two grades, the sample is to be considered as being in the higher grade.

Any sample of honey which falls in the water-white grade, or which is lighter than any honey that can be matched on the grader, is, of course, to be classed as water white. In like manner, any sample of dark honey which falls below the limits available for dark honey on the grader scale will still be classed as dark honey.

In grading any sample, if it is desired to give a closer description of the color than is afforded by the standard grades the millimeter scale may be used; for instance, if the sample grades as light amber, but falls in the lighter part of the scale, the seller may wish to state that his honey graded light amber with a reading of, for

instance, 5.1; or if it falls in the darker portion of the grade he might say that the sample was light amber, with a reading of, for instance, 8.2. The use of this millimeter scale is not, however, to be considered a necessary part of the grading.

In using the grader it is well to place it at a window opening toward the sky, with most of the light excluded except that falling on the

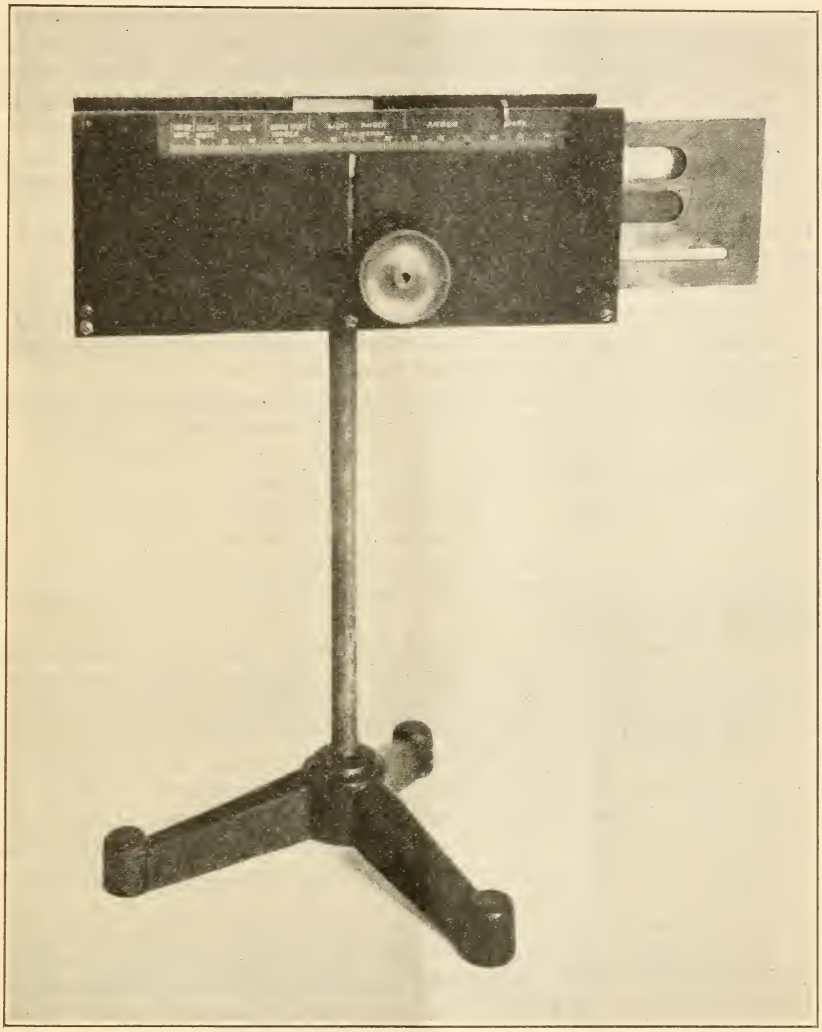

FIG. 1.—The grader devised and officially adopted by the Division of Bee Culture Investigations and the Bureau of Agricultural Economics for the color grading of honey

grader. It is advisable to make two or three successive readings of the same sample, so as to avoid any chance of error. After taking the readings for any sample of honey the trough should be washed carefully and dried before another sample is placed in it. Nothing but water should be used in washing the trough, and the water should not be hot.

DEVELOPMENT AND DESCRIPTION OF THE STANDARD GRADER[14]

As a rule the honeys of light color bring a somewhat better price than the darker grades, and therefore the practice of designating the color has become general. As an aid to uniformity in grading, several color graders for extracted honey have been devised and placed upon the market. An examination of the colors of honeys collected from all parts of the United States and of the colors of the materials used for comparison in these graders revealed the fact that the colors of the graders were not the same as the colors usually found in honeys of similar degrees of darkness. A more serious difficulty arose from the fact that the color graders on the market did not have the same colors for grades of similar designation, so that a buyer using one grader and a seller using another might find themselves engaged in a dispute as to the proper color grade for a certain lot of honey.

It seemed best to make a careful study of the colors found in a large collection of honeys, and then to devise a grader to be used universally in strict conformity with the colors found. This work was taken up in cooperation with the Bureau of Agricultural Economics, and resulted in devising a type of grader whose outstanding feature is its extreme simplicity of operation.

In order that the development of this grader may be understood, the present circular must briefly discuss, with some attention to technical and scientific detail, the incidental studies and preliminary work connected with the choice of standard grades and the perfecting of a grader. A knowledge or understanding of all this is not in any way necessary to satisfactory operation of the grader. Its operation is so simple that in order to grade honey accurately only an understanding of the few paragraphs of instruction given on page 26 is necessary.

By way of preparation for a study of honey colors and for the construction of a satisfactory grader, the bee culture laboratory, under E. F. Phillips, enlisted the cooperation in 1922 and 1923 of a large number of beekeepers in all parts of the country and obtained a collection of over 450 samples of honeys such as appear on the American market. Studies of these honeys and of the problems encountered in preparing a satisfactory honey grader were at once begun and were carried on as time permitted. In 1924 and 1925, under James I. Hambleton, the work was continued until the grader described in this circular was completed.

The transmission of light of various colors (wave lengths) through these honeys was determined by the use of the spectrophotometer. These samples were also on various occasions exhibited to beekeepers and those familiar with the common practices in the honey trade, and in conformity with information obtained in that way the color limits of the several commonly accepted grades were established. An effort was made to adopt the commonly accepted names and limits rather than to attempt to mark off new boundaries or to adopt new and strange names.

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[14] Besides the work of the regular members of the staff of the bee culture laboratory of the Bureau of Entomology, assistance in the research here described has been given by A. H. Pfund, of Johns Hopkins University; H. Wales, of the color laboratory of the Bureau of Chemistry, Department of Agriculture; and by B. Kurrelmeyer and E. W. Tschudi.

REQUISITES OF A STANDARD GRADER

As is well known, the turbidity of honey varies considerably, not only for different honeys but for honey of the same grade coming from different sources and locations. The eye is affected primarily by the color in honey, and but little by the turbidity; whereas a reading given by the spectrophotometer is affected by both these factors. For example, a very turbid honey of the white grade may be classed as belonging in the light-amber grade, or even in the amber, when classified only by the spectrophotometer readings. Furthermore, a given sample of honey undergoes a change in turbidity on standing for a time, so that it is impossible to limit the grades of honey solely on the basis of their transmission of light as measured by the usual spectrophotometer. Since honeys of the same color differ in turbidity, they can not be distinguished solely by their light transmission. In the making of a color grader it is not satisfactory to use merely colored materials for comparison, but the instrument must be so constructed that the varying turbidity of honeys of a given grade does not lead to false determinations of their color grade. This has proved to be the most difficult problem in the making of a satisfactory grader, and the one which baffled all who worked on this research until a grader of the character here presented was devised.

The available data on the light transmission of the grades in terms of readings with the spectrophotometer are here tabulated in order to present the characteristics of the several grades with accuracy. Readings with Lovibond glasses are also included for comparison. These figures are given because of their bearing on the development of the color grader and on the standard grades which have been selected. All honey transmitting less light than the amber grade is classed as dark. A knowledge of these figures is not essential to the operation of the grader, but will be of use in the construction of other graders of different types.

TABLE 1.—*Percentages of light of certain colors transmitted by grades of honey, and corresponding readings with Lovibond glasses*

Color	Percentage of light transmitted, as measured by the spectrophotometer			Readings with Lovibond glasses		
	Blue (480μμ)	Yellow (580μμ)	Red (680μμ)	Blue	Yellow	Red
Water White	64.0	77.0	81.5	0.54	1.05	0.52
Extra White	60.0	76.0	80.5	.58	1.40	.66
White	50.0	71.0	78.0	1.15	3.00	1.33
Extra Light Amber	48.0	70.0	77.0	1.70	3.28	1.95
Light Amber	34.5	63.0	73.0	1.80	5.14	2.10
Amber	15.0	49.0	63.0	2.00	13.00	4.00

As previously stated, these readings for light transmission depend in part upon the degree of turbidity of the honey used in each case, a fact which must be taken into account in comparisons of such readings with determinations made by the use of the honey grader.

It might at first thought be supposed that standard samples of honey could be chosen, and that these would serve as standards for the honeys of similar grades. For several reasons, however, this is

not the case, chief among them being the tendency of honey to change color and appearance with age. At first the turbidity may decrease, making the honey clearer; then the color deepens, the darkening becoming quite perceptible at the end of two years, and in some honeys much earlier, until after 15 or 20 years most of the light honeys become quite amber in color.

Many attempts were made to produce solutions with color and turbidity representing the average turbidity found in honey, and thus to represent the boundaries between the various grades, but all these attempts failed, either through lack of permanency of the solutions themselves, lack of permanency in color, failure to retain the necessary turbidity, or other reasons that often could not be known until after considerable time had elapsed. All these trials delayed the completion of the work.

It seemed important to devise a type of grader in which no consideration need be given to turbidity, as must be done in the use of the spectrophotometer, so that all honeys falling within the range of the grader could be classed accurately, and it is believed that the grader herein illustrated and described meets all the conditions imposed by the peculiar composition and character of honey.

DESCRIPTION OF GRADER

The grader (fig. 1) is composed primarily of a wedge-shaped prism of glass of the proper thickness, angle, and color, mounted with a correspondingly designed wedge-shaped glass trough in which the sample of honey to be graded is placed. By means of a rack and pinion the plate on which the prism and the honey trough are mounted is moved to right or left while the honey and the prism are viewed through properly designed openings in the front and rear plates of the case of the instrument. A pointer is fixed on the movable plate. When the appearance of the honey in the trough and that of the glass prism below it are exactly alike as seen through the narrow slot in the front of the case, the position of the pointer on the movable plate in respect to the graduations on the scale determines the grade of the honey.

Besides the divisions marking the limits of the various grades of honey, the scale is also provided with centimeter and millimeter graduations which may be used if it is desired to make an exact reference to the position of the pointer on the scale.

Numerous tests have shown that different persons, when grading the same sample of honey on a grader of this character, can determine the proper grading so accurately that the personal factor is practically eliminated, and that the grading is more accurate than is possible where a sample of honey in a vial is compared with a similar color sample. The method of construction of this grader minimizes the confusing effects of the various colors and shades of color and the varying turbidities of honeys, so that a close approach to perfect grading can be accomplished.

Green trees or other varicolored backgrounds also materially affect the appearance of a sample of honey. If clear blue sky were always available little trouble would be experienced with light from this source, but in practice graders would ordinarily be used where window frames, trees, or other obstructions would modify light condi-

tions sufficiently to cause errors in grading. It has been found that with the grader described this matter of variations in the background can be taken care of satisfactorily by the use of a sheet of ground or diffusion glass in the slot through the back of the case.

Although the type of grader illustrated is more expensive than the graders heretofore in use, no satisfactory, permanent, and accurate grader that can be sold at a low price has yet been devised. The Bureau of Agricultural Economics has therefore decided that the standard grades of honey shall be those determined by the Division of Bee Culture Investigations in accordance with its researches, and that it will use a grader of the type described for the determination of these grades.

The five standard grades of color heretofore in use were as follows: Water White, White, Light Amber, Amber, and Dark. In response to the demand from western beekeepers for further subdivisions of the lighter grades, two additional grades were established as subdivisions of the White and Light Amber grades, these being designated as Extra White and Extra Light Amber. In establishing the limits of these extra grades it seemed best not to divide a grade into two equal parts, but to place the color limits so that approximately 30 per cent of the honeys in the White or the Amber grade were included in the "Extra" grade. This division results in the choicest honeys in either grade, so far as color is concerned, falling into the corresponding "Extra" grade.

FUTURE DEVELOPMENT OF GRADERS

As has already been remarked, because of the tendency of honeys to darken and change in other characteristics than color, it is impossible to use them as permanent standards for comparison. It may be possible, however, to use in a grader honey or some comparable color solution that will be satisfactory for one or two seasons. It may also be found that most beekeepers will not require a grader that will cover the whole series of grades from water white to amber, but that two or three grades will be sufficient for the personal use of the majority of beekeepers. If such is found to be the case, as well may happen, the grader herein described may then be used for standardizing such temporary or small and less expensive graders as might be desired for use in regions producing only a few grades of honey for the market.

In the work which has been done on grading honey by comparison between a standard color in a bottle and a sample, similar in size and shape, of the honey to be graded, some things have been demonstrated which may well be included in this discussion of honey grading.

In graders previously used in this country the materials are placed in narrow bottles, but with too narrow a bottle the finer gradations in color are not easily distinguished. It is therefore recommended that round bottles having a diameter approximately of 1⅛ inches be used. Whatever the size of the bottle, bottles of the same size should be used to contain the samples to be graded. Any variation in the sizes of the bottles used for the samples of honey will lead to errors in the grading.

In making a holder for sample bottles it is recommended that a wooden framework be used, painted or stained a dull black, as any color in the framework reflects light both to the standard liquids and to the samples of honey. Under usual circumstances a frame holding four samples would be sufficient. The face of the grader should be made of some thin material, presumably metal, having slits cut to permit the middle of the grader bottles and the middle of the sample bottles to be viewed, but so as to cut off the edges of both types of bottles. Where the edges of round bottles are visible there is so great confusion due to variation in thickness of the materials as to make grading uncertain. It is further recommended that the back of the framework be fitted with a sheet of ground or diffusion glass to insure the passage of diffused light through both grader and honey bottles. This precaution, already suggested, is necessary to accurate grading.

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